

of animals; such hypotheses are always dependent on our actual biological knowledge and may be changed at any time for better ones, while the theory as a whole needs no further proof; it is absolutely certain. But for the objective zoologist it is impossible, according to the principles of comparative systematics, to assign to man any other place in the animal kingdom than in the order of apes, or primates, as Linnæus calls them; this classification, which is inevitable, leads to the common descent of man and ape from one ancestral form; and this is the essential part of the question. The views as to the exact appearance of this ancestral form may be divided, but we must eventually arrive at the conclusion, if we consider all facts connected with the subject, that our long extinct ancestors can but have been real apes, *i.e.*, some placental mammal, which, if it existed to-day, we should certainly classify among apes. Finally, Haeckel points out how characteristic it is of Virchow's view on the matter that he again places palæontology into the foreground, and, before accepting the theory of descent, demands that an uninterrupted series of fossil transition forms between ape and man should first be found. As Darwin himself has minutely stated the reasons why the solution of this problem cannot be expected, and has shown the cause of the extraordinary incompleteness of the palæontological records, and of the natural impediments to a geological proof of the ancestral tree (in Chapter X. of the "Origin of Species"), Haeckel again arrives at the conclusion that Virchow has never attentively read Darwin's great work, and has never digested the teachings of palæontology.

Chapter IV. is entitled "Cell-Soul and Cellular Psychology." Haeckel states here that the views he expressed at Munich with regard to the soul of the cell, *i.e.*, "that we must indeed ascribe an independent soul-life to each organic cell," are but the natural consequence of Virchow's own teachings, *viz.*, of the very fertile application which Virchow made of the cell theory to pathology. He then proceeds to give the definition of the word "soul" according to both philosophical theories, first according to the monistic or realistic theory, and then according to the dualistic or spiritualistic theory; he compares the simplicity of the former with the mystery and irrationality of the other. He adduces the various phrases in Virchow's address which leave no doubt on the subject that Virchow has completely abandoned the realistic theory in favour of the dualistic one, and shows the utter futility of Virchow's view that we cannot find psychic phenomena in the lower animals. "Volition and sensation, the most general and most indubitable qualities of all mental life, cannot be overlooked in the lower animals. Indeed, with most *Infusoria*, particularly with *Ciliata*, independent motion and conscious sensation (of pressure, heat, light, &c.) are so very evident, that one of their most patient observers, Ehrenberg, maintained up to his death that all *Infusoria* must have nerves and muscles, organs of sense and of mind (*Selenorgane*) just like all higher animals.

"Now it is known that the enormous progress which science has recently made in the natural history of these low organisms has reached its climax in the maxim that they are *unicellular* (a maxim which Siebold pronounced thirty years ago, but which has been proved with certainty only recently); therefore in the *Infusoria* a single cell performs all the different functions of life, including the mental functions, which in the *Hydra* and *Spongia* are divided amongst the cells of the two germinal lobes, and in all higher animals amongst those of the various tissues, organs, and apparatus of a complicated organism. . . . By the same right by which we ascribe an independent 'soul' to these unicellular *Infusoria*, we must ascribe one to all other cells, because their most important active substance, the protoplasm, shows everywhere the same psychic properties of sensitiveness (sensation) and movability (volition). The difference in the higher organisms is only that there the numerous single cells give up their individual independence, and like good state-citizens, subordinate themselves to the 'state-soul' which represents the unity of will and sensation in the 'cell-association.' We must distinguish between the central soul of the total polycellular organism or the 'personal soul' and the separate elementary souls of the single cells, or 'cell-souls.' This maxim is excellently illustrated by the interesting group of *Siphonophora*. There is no doubt that the whole *Siphonophora*-state has a very determined and uniform (*einheitlich*) will and sensation; yet each one of the single individuals which compose this state (or *Cornus*) has its separate personal will and sensation. Indeed each one of these is originally a separate *Medusa* and the 'individual' *Siphono-*

phora-state has resulted only by association and division of labour of this united society of *Medusa*. Next to the unicellular *Infusoria* no phenomenon affords such ample and immediate proof for the truth of our cellular-psychology than the fact that the *human ovum*, like the ovum of all other animals, is a simple and single cell. According to our monistic conception of the cell-soul, we must suppose that the fertilised ovum already possesses *virtually* those psychic properties which in the particular mixture of parental peculiarities (*i.e.*, those of mother and father) characterise the individual soul of the new being. In the course of the development of the ovum the cell-soul of course develops itself simultaneously with its material substratum, and becomes apparent *actually* when the child is born. According to Virchow's dualistic conception of the 'Psyche,' we must suppose, on the contrary, that this immaterial being enters the soulless germ at some period of embryonal development (perhaps when the spinal tube separates from the germinal lobe?). Of course this way the pure miracle is complete, and the natural and uninterrupted continuity of development is superfluous."

(To be continued.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

ST. PETER'S COLLEGE, CAMBRIDGE, has made a statute assigning one of its Fellowships to the Jacksonian Professor. It is intended to limit this professorship by statute to some branch or branches of chemistry or physics, a specially constituted electoral body, including representatives of non-resident science, making the selection freely on each occasion of a vacancy.

THE site most favoured for the Sedgwick Memorial Museum, Cambridge, is Downing Street, in front of the present new museums. There will be a good opportunity of concealing from public view these extremely plain buildings and of erecting a satisfactory façade. The Sedgwick Committee have informed the University that 1,200*l.* is in their hands for this purpose, but this amount is insufficient, and the University, when better supplied with funds, must supply a good deal more. A Syndicate, including Drs. Paget and Humphry, Profs. Liveing, Newton, Hughes, and Colvin, has just been appointed to select a site, to obtain plans, to confer with the Sedgwick Committee, and report by midsummer next.

PROF. LEITH ADAMS, F.R.S., has been appointed to the Chair of Natural History in the Queen's University of Ireland, rendered vacant by the lamented death of Prof. Harkness.

SOCIETIES AND ACADEMIES LONDON

Royal Society, November 21.—"On a Method of Using the Balance with great Delicacy, and its Employment to Determine the Mean Density of the Earth," by J. H. Poynting, B.A., Fellow of Trinity College, Cambridge, and Demonstrator in the Physical Laboratory, Owens College. Communicated by Prof. Balfour Stewart, LL.D., F.R.S.

The two chief causes of error in the use of the balance are:—
1. Disturbances through changes of temperature, such as convection currents, or unequal expansion of the two arms. 2. The possibility that after raising the beam on the supporting frame and lowering it again, the same parts of the knife edges may not come into contact with the planes. Errors from the first cause may be to a great extent avoided by protecting the balance with a gilded case, and reading the oscillations from a distance by means of a mirror on the beam. The residual effects may then be detected by taking three observations at equal intervals of time, the first and third having the same weights in the pan, and their mean being compared with the second (*i.e.*, for a short time the disturbance is assumed to be a linear function of the time). The second cause of error has been removed by not raising the beam between successive weighings. For this purpose a clamp is placed underneath one pan, which can be brought into action at any time to fix the pan in whatever position it may be. The weights can then be interchanged while the counterpoise (Borda's method being employed) maintains the beam in the same state of flexure, and the knife edges always remain in contact with the same parts of the planes.

The value of a given deflection was estimated by riders, and the weights were interchanged each by special arrangements.

The greatest deviation from the mean in the comparison of two 1 lb. weights in one group of twenty comparisons, when the weather was unfavourable, was 1.20 millionth of 1 lb., while in another group of twenty-seven comparisons (the weather being much finer and more favourable) the greatest error was 1.50 millionth.

To determine the mean density of the earth, a 1 lb. weight was hung from one arm of the balance at a distance of about six feet below it, and was accurately counterpoised in the other pan. A large sphere of lead (about 340 lbs.) was then alternately inserted under the hanging weight, and withdrawn. The difference which its attraction made in the weight of the hanging weight was about 1.45 millionth of 1 lb. This increase of the weight was measured as accurately as possible by means of riders on the beam of the balance. Comparing this with the attraction of the earth on the weight—that is, its weight—we can calculate the mass of the earth in terms of the mass of the lead sphere. The results hitherto obtained are only preliminary, though they seem near enough to former determinations to show that with improved arrangements which the author intends to make, a good value may ultimately be obtained. The mean of 11 determinations is 5.69, with a probable error of 0.15.

Physical Society, November 23.—Prof. W. G. Adams, president, in the chair.—Prof. Ayrton read a paper on the music of colour and of visible motion, which we give elsewhere.—Dr. Schuster then described his new method of adjusting the collimator of the spectroscope for parallel rays of different refrangibility. His plan is very simple, and is based on the fact that if the rays entering the prism are parallel, the focus seen in the telescope will remain constant when the prism is turned round, but if they are not parallel, the focus will shift. The process, therefore, consists in looking through the telescope while turning the prism. If the focus shifts, the collimator has to be adjusted until no shifting takes place. The adjustment must be made with a prism whose sides are perfectly plane, and a good one may be kept for the purpose.

Statistical Society, November 19.—A numerous list of candidates were balloted for and elected Fellows.—The Howard prize medal, with 20*l.*, has been awarded to Surgeon John Martin, L.R.C.S. Edin., of the Army Medical Department, at present serving in India with the Royal Artillery. An extra prize medal has also been awarded to Capt. H. Hildyard, of the 71st Highland Light Infantry, his essay being scarcely inferior to that of Mr. Martin.—The President, Mr. G. J. Shaw-Lefevre, M.P., in his opening address, commented on the past work of the Society, especially the papers read by its members during the past session, and the various statistics collected through its operations. Their great object was to study the past so as to understand the present and be able to give a forecast of the future.—Prof. Jevons afterwards exhibited and explained to the meeting the arithmometer of M. Thomas, long in use among actuaries.

EDINBURGH

Royal Society, November 25.—The following office-bearers were elected:—President, Prof. Kelland; Vice-Presidents, David Stevenson, C.E., Bishop Cotterill, Sir Alexander Grant, Bart., David Milne Home, Sir C. Wyville Thomson, Prof. Douglas MacLagan; General Secretary, Prof. Balfour; Secretaries to Ordinary Meetings, Prof. Tait, Prof. Turner; Treasurer, David Smith; Curator of Library and Museum, Alexander Buchanan; Council, Prof. Fleeming Jenkin, Rev. R. Boog Watson, Dr. Hugh Cleghorn, Prof. T. P. Fraser, Prof. Rutherford, Dr. R. M. Ferguson, Rev. W. Lindsay Alexander, Dr. Thomas A. G. Balfour, J. T. Buchanan, Rev. Thomas Brown, Robert Gray, and Dr. William Robertson.

PARIS

Academy of Sciences, November 25.—M. Fizeau in the chair.—The following papers were read:—Critical examination of a posthumous writing of Claude Bernard on alcoholic fermentation, by M. Pasteur. He represents this writing as a sterile attempt to substitute for facts well established the deductions of an ephemeral system.—On the reduction in continuous fractions of $e^{F(x)}$, $F(x)$ designating an entire polynome, by M. Laguerre.—On isosceles figures, by M. Badoureaux.—Reply to various communications by M. Levy.—Reclamation of priority, in regard to M. Werdermann's communication on an electric lamp, by M. Regnier.—On a new phenomenon of static electricity, by M. Duter. In certain cases electrification may change the volume of bodies. A large thermometric envelope containing

water is made into a condenser by pushing a piece of platinum wire into its exterior, and fixing outside a sheet of tin. Whenever, like a Leyden jar, it receives a charge, the water is observed to descend, remain stationary while the charge persists, and resume its former level on discharge. It is inferred that the glass is dilated. With any kind of armatures the same result is had. Another experiment was to place the above-mentioned arrangement in another thermometric envelope containing water; on electrifying, the water in the measuring-tube of the outer envelope rose, while the other fell. M. Jamin recalled the fact that M. Govi, ten years ago, made an experiment similar to M. Duter's first, and attributed the effect to a contraction of the liquid; M. Duter's second experiment proves that the expansion of the glass is really the cause.—Reply to a note of M. Meunier on the artificial crystallisation of orthose, by MM. Fouqué and Levy. M. Meunier (they hold) had not sufficient data to determine the nature of the minerals produced; his experiments are a mere repetition of those of James Hall in 1798, who fused natural rocks, subjected them to long annealing, and found the metal grains obtained had sometimes a crystalline texture. The authors, far from having got results with orthose like those of M. Meunier, find a marked difference between this felspar and others as to its structure after reproduction by igneous fusion; it does not take the ordinary crystalline structure, and this reveals the necessity of intervention of volatile elements in genesis of acid rocks.—Note on the element called *Mosandrum*, by Prof. Lawrence Smith. He claims priority in having called attention to the absence of the oxide of cerium, and to new characters of certain earths in the mineral samarskite, and having indicated a new one he called *mosandrum*.—Double stars; certain groups of perspective, by M. Flammarion. He gives a list of couples that are merely optical groups, due to the meeting, in the same visual ray, of stars situated one beyond the other in space, and having different proper motions.—On the number of complete arrangements where consecutive elements satisfy given conditions, by M. André.—On various derivatives of spirit of turpentine, by M. De Montgolfier. He has studied the action of sodium chiefly in chlorhydrates of turpentine, solid and liquid.—On a cyanised derivative of camphor, by M. Haller.—Action of salts of chromium on salts of aniline in presence of chlorates, by M. Grawitz. He notes the advantage of using these salts in place of vanadic salts; they are less rare and dear, and have even greater energy. $\frac{1}{10}$ of a milligramme of bichromate of potash, per 125 grammes of aniline salt dissolved in water, still develops black.—On the physiological action of borax, by M. De Cyon. Borax added to meat to the extent of twelve grammes daily (a quantity ten times that required by the Jourdes process), may be taken in food without causing the least disorder in general nutrition. Substituted for marine salt, borax increases the power of assimilating meat, and may cause a large increase of weight in the animal, even when the alimentation is exclusively albuminoid. This all applies to pure borax only.

CONTENTS

	PAGE
BOTANICAL CHEMISTRY	93
GEOGRAPHICAL ASTRONOMY	94
OUR BOOK SHELF:—	
Tait and Steele's "Treatise on Dynamics of a Particle, with Numerous Examples"	94
Hulme's "Familiar Wild Flowers"	94
LETTERS TO THE EDITOR:—	
The Telephone.—Prof. JAMES C. WATSON	95
The Intra-Mercurial Planets.—Prof. LEWIS SWIFT	96
Colour-Variation in Lizards.—Corsican Herpetology.—Dr. HENRY HILLIER GIGLIOLI	97
Commercial Crises and Sun-Spots.—JOHN KEMP	97
Strange Properties of Matter.—CHARLES A. FAWCITT	98
Galvanometer for Strong Currents.—EUGEN ORACH	98
Utilisation of the African Elephant.—H. L. JENKINS	99
OUR ASTRONOMICAL COLUMN:—	
Orbits of Binary Stars	99
Lalande's Stars, Nos. 5,499 and 45,400	99
The Annular Eclipse of January 22, 1879	99
GEOGRAPHICAL NOTES	99
ON THE DEVELOPMENT OF THE GARPIKE. By Prof. E. PERCEVAL WRIGHT	100
THE MUSIC OF COLOUR AND MOTION	101
THE SWEDISH NORTH-EAST PASSAGE EXPEDITION	102
THE FORMATION OF MOUNTAINS. By Prof. ALPHONSE FAVRE (With Illustrations)	103
GEORGE HENRY LEWES	106
NOTES	107
ROYAL SOCIETY—THE PRESIDENT'S ANNIVERSARY ADDRESS. By Sir JOSEPH HOOKER, K.C.S.I., C.B., F.R.S.	109
HARCKEL ON THE LIBERTY OF SCIENCE AND OF TEACHING	113
UNIVERSITY AND EDUCATIONAL INTELLIGENCE	115
SOCIETIES AND ACADEMIES	115